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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/674,978	11/08/2000	Nobuhiro Sadatomi	66409-202-7	8771

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DYKEMA GOSSETT PLLC
FRANKLIN SQUARE, THIRD FLOOR WEST
1300 I STREET, NW
WASHINGTON, DC 20005

EXAMINER	
PARSONS, THOMAS H	

ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 06/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/674,978	SADATOMI ET AL.	
	Examiner	Art Unit	
	Thomas H Parsons	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 April 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22 and 24* is/are rejected.

7)☐ Claim(s) *23* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☒ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Response to Amendment

This is in response to the amendment filed 23 April 2004.

DETAILED ACTION

Specification

1. The objection to the abstract has been **withdrawn** in view of Applicants' amendment.

2. The objection to the disclosure because of minor informalities has been **withdrawn** in view of Applicants' amendment.

Priority

3. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Japan on 10 March 1999. It is noted, however, that applicant has not filed a certified copy of the Japanese application (JP11-063088) as required by 35 U.S.C. 119(b).

Claim Rejections - 35 USC § 102

4. The rejection of claims 1, 7-13, 16, 18 under 35 U.S.C. 102(b) as being anticipated by Penn (3,898,080) has been **withdrawn** in view of Applicants' amendment.

Claim Rejections - 35 USC § 103

5. The rejection of claims 2, 4, and 17 under 35 U.S.C. 103(a) as being unpatentable over Penn has been **withdrawn** in view of Applicants' amendment.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

7. Claims 1-14, 16-22 and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Yamashita et al. (6,506,321).

The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Claim 1: Yamashita et al. disclose a thermoelectric conversion material having a crystal structure in which a added element or a combination of added elements is or are contained in an amount of 0.001 to 30 at% in silicon (col. 5: 15-22).

Although Yamashita et al. do not explicitly disclose **at least one type of added element is deposited on crystal grains in which silicon accounts for at least 80 % of the polycrystal structure, and at the grain boundary thereof**, the thermoelectric material of Yamashita et al. would inherently provide the claimed recitation as the material of Yamashita et al. is of the same composition and is manufacture the same as instantly disclosed.

Claim 2: Yamashita et al. disclose a thermoelectric conversion material having a crystal structure in which a dopant or a combination of dopants that generate carriers is or are contained in an amount of 0.001 to 20 at% in silicon (0.5 to 20 at% as per col. 5: 19-21).

Although Yamashita et al. do not explicitly disclose **at least one type of added element is deposited on crystal grains in which silicon accounts for at least 80 % of the polycrystal structure, and at the grain boundary thereof**, the thermoelectric material of Yamashita et al. would inherently provide the claimed recitation as the material of Yamashita et al. is of the same composition and is manufacture the same as instantly disclosed.

Claim 3: Yamashita et al. disclose a thermoelectric conversion material having a crystal structure in which a dopant or a combination of dopants that generate carriers is or are contained in an amount of 0.001 to 20 at% in silicon (0.5 to 20 at% as per col. 5: 19-21), and an added element or a combination of added elements that do not generate carriers is or are contained in an amount of 0.1 to 10 at% (0.1 to 25 at% as per col. 5: 15-19).

Although Yamashita et al. do not explicitly disclose **at least one type of added element is deposited on crystal grains in which silicon accounts for at least 80 % of the polycrystal structure, and at the grain boundary thereof**, the thermoelectric material of Yamashita et al. would inherently provide the claimed recitation as the material of Yamashita et al. is of the same composition and is manufacture the same as instantly disclosed.

Claim 4: Yamashita et al. disclose a thermoelectric conversion material having a crystal structure in which a dopant or a combination of dopants that generate carriers is or are contained in an amount of 0.001 to 20 at% in silicon (0.5 to 20 at% as per col. 5: 19-21), and an added element or a combination of added elements that do not generate carriers is or are contained in an amount of 0.1 to 10 at% (0.1 to 25 at% as per col. 5: 15-19).

Although Yamashita et al. do not explicitly disclose **at least one type of added element is deposited on crystal grains in which silicon accounts for at least 80 % of the polycrystal structure, and at the grain boundary thereof**, the thermoelectric material of Yamashita et al. would inherently provide the claimed recitation as the material of Yamashita et al. is of the same composition and is manufacture the same as instantly disclosed.

Claim 5: Yamashita et al. disclose a thermoelectric conversion material having a crystal structure in which a dopant or a combination of dopants that generate carriers is or are contained in an amount of 0.001 to 20 at% in silicon (0.5 to 20 at% as per col. 5: 19-21), and an added element or a combination of added elements that do not generate carriers is or are contained in an amount of 0.1 to 10 at% (0.1 to 25 at% as per col. 5: 15-19).

Although Yamashita et al. do not explicitly disclose **at least one type of added element is deposited on crystal grains in which silicon accounts for at least 80 % of the polycrystal**

structure, and at the grain boundary thereof, the thermoelectric material of Yamashita et al. would inherently provide the claimed recitation as the material of Yamashita et al. is of the same composition and is manufacture the same as instantly disclosed.

Claim 6: Yamashita et al. disclose a thermoelectric conversion material having a crystal structure in which a added element or a combination of added elements that do not generate carriers is or are contained in an amount of 5 to 10 at% (0.1 to 25 at% as per col. 5: 15-19), at least one type of Group III-V compound semiconductor or Group II-VI compound semiconductor is contained in an amount of 1 to 10 at% (col. 15: 5-25 and Table 7-1), and a dopant or a combination of dopants that do generate carriers is or are contained in an amount of 0.001 to 5 at % in silicon (0.5 to 20 at% as per col. 5: 19-22).

Although Yamashita et al. do not explicitly disclose **at least one type of added element is deposited on crystal grains in which silicon accounts for at least 80 % of the polycrystal structure, and at the grain boundary thereof**, the thermoelectric material of Yamashita et al. would inherently provide the claimed recitation as the material of Yamashita et al. is of the same composition and is manufacture the same as instantly disclosed.

Claim 7: Yamashita et al. disclose that of the added elements, the one that generates carriers and is used to make a p-type semiconductor is one or more selected from the group consisting of an Ap1 group (Be, Mg, Ca, Sr, Ba, Zn, Cd, Hg, B, Al, Ga, In, Tl) and transition metal elements M_1 (Y, Mo, Zr)(col. 3: 53-58).

Claim 8: Yamashita et al. disclose that of the added elements, the one that generates carriers and is used to make a n-type semiconductor is one or more selected from the group consisting of an An1 group (N, P, As, Sb, Bi, O, S, Se, Te), transition metal elements M_2 (Ti, V,

Cr, Mn, Fe, Co, Ni, Cu, Nb, Ru, Rh, Pd, Ag, Hf, Ta, W, Re, Os, Ir, Pt, Au; where Fe accounts for 10 at% or less), and rare earth elements RE (La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Yb, Lu) (col. 3: 58-64).

Claim 9: Yamashita et al. that of the added elements, the one that does not generate carriers is one or more types selected from the group consisting of Group IV elements other that silicon, Group III-V compound semiconductors, and Group II-VI compound semiconductors (col. 15: 15-25, Table 7-1; col. 7: 36-40).

Claim 10: Yamashita et al. disclose that the material is an ingot quenched from a melt, a sinter, and a material having a porosity of 5 to 40% (col. 29: 45-47; col. 31, Table 16-2 and 16-3, and col. 9: 34-43).

Claim 11: Yamashita et al. disclose that the material consists of a p-type or n-type semiconductor material whose carrier concentration is 10^{17} to 10^{21} (M/m^3) and whose thermal conductivity is not more that 50 W/mK) (col. 6: 54-57; col. 13, Table 3, nos. 19, 20; Table 4, nos. 40, 41, Tables 12-1, nos. 29, 30, Table 13-1, nos. 59, 60; and col. 7: 25-29).

Claim 12: Yamashita et al. discloses that the added element that does not generate carriers is germanium, and the carrier concentration of the semiconductor is 10^{17} to 10^{21} (M/m^3).

Claim 13: Yamashita et al. disclose a step of cooling a melt such that the added elements are contained in silicon (col. 8: 26-31).

Although Yamashita et al. do not explicitly disclose **at least one type of added element is deposited on crystal grains in which silicon accounts for at least 80 % of the polycrystal structure, and at the grain boundary thereof**, the thermoelectric material of Yamashita et al.

would inherently provide the claimed recitation as the material of Yamashita et al. is of the same composition and is cooled the same as instantly disclosed.

Claim 14: Yamashita et al. disclose that the melting is arc melting or high-frequency melting (col. 8: 19-20).

Claim 16: Yamashita et al. disclose a step of powderizing (pulverizing) a material containing a added element in silicon, and a step of sintering the powder (col. 9: 34-47).

Although Yamashita et al. do not explicitly disclose **at least one type of added element is deposited on crystal grains in which silicon accounts for at least 80 % of the polycrystal structure, and at the grain boundary thereof**, the thermoelectric material of Yamashita et al. would inherently provide the claimed recitation as the material of Yamashita et al. is of the same composition and is powderized and sintered the same as instantly disclosed.

Claim 17: Yamashita et al. disclose a step of cooling a melt such that added elements are contained in silicon, a step of powderizing the material thus obtained, and a step of sintering the powder (col. 9: 34-47).

Although Yamashita et al. do not explicitly disclose **at least one type of added element is deposited on crystal grains in which silicon accounts for at least 80 % of the polycrystal structure, and at the grain boundary thereof**, the thermoelectric material of Yamashita et al. would inherently provide the claimed recitation as the material of Yamashita et al. is of the same composition and is cooled, powderized and sintered the same as instantly disclosed.

Claim 18: Yamashita et al. disclose a powder with an average crystal grain diameter of 1 to 50 μm and an average particle diameter of 3 to 100 μm is sintered (col. 9: 34-47).

Claim 19: Yamashita et al. disclose a step of coating a silicon powder with a added element or embedding the latter in the former, and a step of sintering the silicon powder.

Although Yamashita et al. do not explicitly disclose **at least one type of added element is deposited on crystal grains in which silicon accounts for at least 80 % of the polycrystal structure, and at the grain boundary thereof**, the thermoelectric material of Yamashita et al. would inherently provide the claimed recitation as the material of Yamashita et al. is of the same composition and the step of coating or embedding is the same as instantly disclosed.

Claim 20: Yamashita et al. disclose that the added element is contained in the silicon itself (col. 9: 34-38)

Claim 21: Yamashita et al. disclose that the coating step is a vapor phase growth process (col. 36: 49-50).

Claim 22: Yamashita et al. disclose that the embedding step is mechanofusion treatment (i.e. microcrystallization by mechanical alloying) (col. 9: 41-42).

Claim 24: Yamashita et al. disclose a step of cooling a melt such that added elements are contained in silicon, a step of powderizing the material thus obtained, and a step of sintering (low temperature hot pressing) the powder (col. 9: 34-47).

Although Yamashita et al. do not explicitly disclose **at least one type of added element is deposited on crystal grains in which silicon accounts for at least 80 % of the polycrystal structure, and at the grain boundary thereof**, the thermoelectric material of Yamashita et al. would inherently provide the claimed recitation as the material of Yamashita et al. is of the same composition and is cooled, powderized and sintered the same as instantly disclosed.

8. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamashita et al. as applied to claim 13 above, and further in view of Arita et al. (Thermoelectric Properties of Ru_2Si_3 Prepared by Fz and Arc Melting Methods.

Yamashita et al. are as applied, argued, and disclosed above, and incorporated herein.

Claim 15:Yamashita et al. do not disclose a CZ method, an FZ method, or a ZL method.

Arita at al. disclose a method of manufacturing a similar thermoelectric conversion material by an FZ method.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yamashita et al. by incorporating the FZ method of Arita et al. because Arita et al. teach an FZ method that would have provided a thermoelectric conversion material having a large value of Figure of merit mainly due to high electric conductivity (page 396, col. 2, lines 1-5) thereby improving the overall performance of energy conversion.

Allowable Subject Matter

9. Claim 23 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Reasons for Indicating Allowable Subject Matter

10. The following is a statement of reasons for the indication of allowable subject matter:

Yamashita et al. are concerned with a silicon-based material in which the silicon is made (formed) to contain various elements (i.e. added elements) and wherein a thin film can be produced and patterned, allowing a conduction path be to formed as desired.

In contrast, the claimed invention is directed forming and laminating layers of silicon and layers including added elements, either alternately or in the required pattern, and subjecting the laminated layers to a heat treatment which is neither taught nor suggest by Yamashita et al.

Response to Arguments

11. Applicant's arguments, see page 1, lines 5-15, filed 23 April 2004, with respect to the rejection of claims 1, 7-13, 16, 18 under 35 U.S.C. 102(b) as being anticipated by Penn have been fully considered and are persuasive. The rejection of the claims has been withdrawn.

12. Applicant's arguments, see page 1, line 5-15, filed 23 April 2004, with respect to the rejection of claims 2, 4, and 17 under 35 U.S.C. 103(a) as being unpatentable over Penn have been fully considered and are persuasive. The rejection of the claims has been withdrawn.

13. Applicant's arguments, see page 1, lines 19-23, filed 23 April 2004 have been fully considered but they are not persuasive.

The Applicant argues that the presently claimed subject matter has a priority date of March 10,1999 which is before the effective date of Yamashita et al. (June 8, 2000). It is even ahead of the date of the publication date of PCT/JP98/03642, which was May 16, 1999. Thus, this rejection must be withdrawn.

In response, Applicants cannot rely upon the foreign priority papers to overcome this rejection because a translation of said papers has not been made of record in accordance with 37 CFR 1.55. See MPEP § 201.15. Further, the Examiner is not aware of PCT/JP98/03642 as being made a matter of record (i.e. where is it).

Conclusion

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas H Parsons whose telephone number is (571) 272-1290. The examiner can normally be reached on M-F (7:00-4:30) First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Thomas H Parsons
Examiner
Art Unit 1745

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Patrick Ryan
Supervisory Patent Examiner
Technology Center 1700